Remarks and Arguments

Claims 28-33; 35-53; and 55-70 are currently in the application and are presented for reconsideration and reexamination in accordance with the remarks and arguments below.

In the prior art rejections of the Office Action of February 3, 2004, the Examiner rejected Claims 28 - 33, 35, 37, 38, 40, 41, 43 - 47, 49 - 53 and 57 under 35 U.S.C. §102(b) as being anticipated by Ibiden Co., Ltd.'s prior European Patent Application EP 0 816 065 A1 (Naruse et al.)(hereinafter sometimes referred to as "the EP reference"); rejected Claims 29, 48 and 56 under 35 U.S.C. §103(a) as being unpatentable over the EP reference; rejected Claims 54 and 55 under 35 U.S.C. §103(a) as being unpatentable over the EP reference in view of U.S. patent no. 4,036,780 to Suzuki et al.; and rejected Claims 58 - 69 under 35 U.S.C. §103(a) as being unpatentable over the EP reference in view of U.S. patent no. 4,772,508 to Brassell.

By this Amendment, independent Claims 28, 38, 45, 50 and 58 have been amended; previously presented Claims 29-33 and 35-37; 39-44; 46-49; 51-53 and 55-57; and 59-69 are respectively dependent thereon and remain unchanged; an independent Claim 70 that is a combination of Claims 28 and 34 has been added; dependent Claim 34 has been canceled; and the subject matter of Claim 54 has been combined with independent Claim 50, and Claim 54 has been canceled.

The present invention is directed to a ceramic filter that has specific characteristics. In independent Claim 28, these characteristics are that the seal layer that adheres a plurality of filters together has a thickness of .3 to 3 mm and a thermal conductance of .1 to 10 W/mk. In independent Claims 38 and 45, these characteristics are a filter length to cross-section in a direction perpendicular to the flow direction is 0.06 to 0.75 mm/mm^2. In independent Claim 50, these characteristics are an average pore diameter of the filter is 5 to 15 micrometers, an average porosity is 30 to 50%, and the filter has 20% or more of through pores. And, in independent Claim 58, these characteristics are a cell wall having a specific surface area of grains of .1 m^2/g or more.

Rejections under 35 USC §§ 102 and 103

a. Independent Claims 28, 38 and 45 have been rejected as being anticipated by EP 0816065A1 (Naruse et al.). By this

amendment to the claims, each of these independent claims has been amended by restricting the material of the filter, i.e. α-type silicon carbide. The EP0816065 (Naruse et al) reference actually discloses DPF formed from silicon carbide. However, when the examples of a filter in this reference are reviewed, it is seen that the filter is formed from α-type silicon carbide and β-type silicon carbide.

In contrast to this, the present invention as now claimed in independent Claims 28, 38 and 45 is directed to a honeycomb filter that is formed from α-type silicon carbide. The basic unit of a silicon carbide crystal is a regular tetrahedron consisting of Si and C, and shows a polygonal shape owing to arrangement of the tetrahedrons. A physical property value differs by such a polygonal shape. Concretely, arrangement of each tetrahedron shows a Si atom only on one surface of a crystal and a C atom on the other side thereof, hence the crystal sometimes has electric polarity or different chemical reactivity.

The filter according to the present invention is formed from the sintered α-type silicon carbide. Therefore, it is considered that arrangement in different directions, stacking faults and other disadvantages, resulting from the mixture of β-type silicon carbide are lessened.

Because chemical properties such as thermal conductance and the like are different for the different types of silicon carbide, the present invention is produced with a different material. For that reason, the thermal conductance of a filter (segment) in case of using α-type silicon carbide has been greatly improved. The present inventors have found that the use of a thickness and a thermal conductance of a seal layer as claimed can withstand a thermal shock as a whole.

b. Independent Claims 50 has also been rejected as being anticipated by EP 0816065A1 (Naruse et al.). By this amendment, independent Claim 50 has been amended by incorporating the feature of the claim 54, and Claim 54 has been canceled.

The filter according to the present invention is characterized by a filter having a low pressure loss, by a greater decreasing of the impurities and by an increasing of the through pores.

Generally, as silicon carbide is hard to be sintered, sintering is generally made by adding a sintering assistant or

the like. However, when a greater degree of sintering is achieved by adding such assistants, impurities are added as viewed from a finished silicon carbide and a more densified filter is obtained. As a result, the useful open pores of such a filter are clogged, and independent pores in a gap between grains are included. Therefore, even if the porosity is substantially high, if there are many independent pores, the filtering function of the filter is reduced. However, a reduction of the pressure loss across the filter cannot be measured. One of the accomplishments of the present invention is a reduction of independent pores and an increase in open pores. Hence, sintering can be carried out by using a silicon carbide having a different grain diameter.

It is confirmed that the EP0816065 (Naruse et al) reference discloses DPF of silicon carbide (average pore diameter 10 μm and porosity 43%), but the reference does not describe at all any open pores or the problem with impurities.

US4036780 (Suzuki et al.) was used to reject Claim 54, now combined with Claim 50, in combination with the EP reference. The Suzuki et al. reference discloses a catalyst contributed to a carrier of silicon carbide. Concretely, the carrier as a pellet of 2-12 mm in diameter, a spherical, massive or crushed powdery form is filled in a container (adhered with a catalyst solution?) In this case, more than 80% of fine pore volume is occupied by fine pores having the apparent porosity of 20-70% and the pore diameter of less than 100 μm is more than 1 μm and preferably more than 10 μm (column 2, lines 50-65).

Generally, even examples are perused, silicon carbide powder is measured, but not after sintering. Further, the powder is dried after imparting a catalyst. There is described (in column 2, line 65 to column 3, line 5) that a sintered body is formed by adding an organic binder of 50-200 mesh in grain size or the like, kneading, molding and sintering at 2100 to 2400 , but it is also apparent that any means of sintering at such high temperature is not taken.

Therefore, even if an impurity amount of raw material grains (2-12 mm) is in such a degree, the similar numerical value cannot be considered in a silicon carbide sintered body usually having high possibility of adding a sintering assistant.

Therefore, even in combination, the present invention as claimed in amended Claim 50 cannot be rendered obvious.

c. Independent claim 58 has been rejected as being obvious over the combination of the EP reference with U.S. patent No. 4,772,508 (Brassell). Claim 58 has been amended by defining the function of filter as purifying the fluid and burning the particulates. The filter according to the present invention is used under the condition of high temperature, such as a filter for exhaust gas purifier such as diesel engine, heat exchanger for high temperature fluid or vapor, and particularly relates to a honeycomb filter suitable for purifying particulates (essentially consisting of carbon) included in exhaust gas of diesel engine and the like.

It is confirmed that EP0816065 (Naruse et al) discloses DPF of silicon carbide, and US4772508 (Brassell) discloses composite material of carbon-bonded carbon fiber. However, Brassell, viewed as a whole, relates to a filter with the use of carbon-bonded carbon fiber. Please note that such filter is burnt out at high temperature.

Certainly, as a percolating filter of the prior art, even where there is described such expressions of carbon-bonded carbon fiber composite material, ceramic-bonded ceramic fiber composite material and carbon-bonded ceramic fiber combined material (column 1, lines 45-64), as a simple percolating filter, there is included a filter for percolating such as water of low temperature. Such teachings of Brassell cannot be combined with Naruse et al to provide the present invention since a filter would be burnt out at high temperatures if carbon material is used.

d. Newly added Claim 70 is a rewritten combination of Claims 34 and 28. This combination was rejected by the Examiner in the Office Action as being obvious over the combination of the EP reference and the U.S. patent No. 6,126,833 (Stobbe et al.)

It is confirmed that EP0816065 (Naruse et al) discloses DPF of silicon carbide, and USP 6126833 (Stobbe et al) discloses a percolating filter.

It is understood from Fig. 1 and the description that Stobbe's percolating filter is for passing a solution supplied from 32 through a path 12 of a segment 12, percolating it with a filter of the segment, forwarding filtrate to paths 17, 16, and finally discharging the filtrate to an area 31 on the outside.

That is, Stobbe's invention is for passing a solution to a segment, dividing the segment when filtering, and flowing a liquid after percolating a gap between the segments.

In contrast to this, the present invention as embodied in Claim 70, in principle, does not use an adhesive layer between the segments as an exhaust pipe. (If there is an inadvertent gap, the gap can be used.) But for not using it and uniformly regenerating a filter, an adhesive between the segments is specified in thickness and thermal conductance. Therefore, in such a case, the claimed numerical values can accurately regenerate even offsetting the filters from each other.

CONCLUSION

In light of the foregoing, Applicant further submits, in addition to the arguments in the previously filed Amendment, that the application is in condition for allowance. If the Examiner believes the application is not in condition for allowance, Applicant respectfully requests that the Examiner contact the undersigned attorney if it is believed that such contact will expedite the prosecution of the application.

Respectfully submitted,
NATH & ASSOCIATES PLLC

Date: September 24, 2004

Harold L. Novick
Registration No. 26,011

NATH & ASSOCIATES PLLC
1030 Fifteenth Street, N.W.
Sixth Floor
Washington, DC 20005
(202) 775-8383